## و المعادلات الواردة بالباب الأول: و

(1) 
$$N_{2(g)} + 3H_{2(g)} = \frac{500^{\circ}\text{C/200 atm}}{\text{Fe}} = 2\text{NH}_{3(g)}$$

(2) 
$$2SO_{2(g)} + O_{2(g)} = \frac{V_1O_1}{450^{\circ}C} + 2SO_{3(g)}$$

(3) 
$$SO_{3(s)} + H_2O_{(f)} \longrightarrow H_2SO_{4(eq)}$$

(4) 
$$2H_2O_{2(t)} \xrightarrow{MnO_2} 2H_2O_{(t)} + O_{2(g)}$$

(5) 
$$FeCO_{3(s)} \xrightarrow{\Delta} FeO_{(s)} + CO_{2(g)}$$

(6) 
$$2\text{FeO}_{(s)} + \frac{1}{2} O_{2(g)} \xrightarrow{\Delta} \text{Fe}_2 O_{3(s)}$$

(7) 
$$2Fe_2O_3.3H_2O_{(s)} \xrightarrow{\Delta} 2Fe_2O_{3(s)} + 3H_2O_{(v)}$$

(8) 
$$S_{(s)} + O_{2(g)} \xrightarrow{\Delta} SO_{2(g)}$$

(9) 
$$4P_{(s)} + 5O_{2(g)} \xrightarrow{\Delta} 2P_2O_{5(g)}$$

(10) 
$$C_{(s)} + O_{2(g)} \xrightarrow{\Delta} CO_{2(g)}$$

(11) 
$$CO_{2(g)} + C_{(s)} \xrightarrow{\Delta} 2CO_{(g)}$$

(12) 
$$3CO_{(g)} + Fe_2O_{3(s)} \xrightarrow{\Delta} 2Fe_{(s)} + 3CO_{2(g)}$$

(13) 
$$2CH_{4(g)} + CO_{2(g)} + H_2O_{(v)} \xrightarrow{\Delta} 3CO_{(g)} + 5H_{2(g)}$$

(14) 
$$2Fe_2O_{3(s)} + 3CO_{(g)} + 3H_{2(g)} \xrightarrow{\Delta} 4Fe_{(s)} + 3CO_{2(g)} + 3H_2O_{(v)}$$

(15) 
$$3Fe_{(s)} + 2O_2 \xrightarrow{\Delta} Fe_3O_{4(s)}$$

(16) 
$$3Fe_{(s)} + 4H_2O_{(v)} \xrightarrow{500^{\circ}C} Fe_3O_{4(s)} + 4H_{2(g)}$$

(17) 
$$2Fe_{(s)} + 3Cl_{2(g)} \xrightarrow{\Delta} 2FeCl_{3(s)}$$

(18) 
$$Fc_{(s)} + S_{(s)} \xrightarrow{\Delta} FcS_{(s)}$$

(19) 
$$Fe_{(s)} + H_2SO_{4(aq)} \xrightarrow{dil} FeSO_{4(aq)} + H_{2(g)}$$

(20) 
$$Fe_{(s)} + 2HCl_{(aq)} \xrightarrow{dil} FeCl_{2(aq)} + H_{2(g)}$$

(21) 
$$3Fe_{(s)} + 8H_2SO_{4(f)} \xrightarrow{\Delta} FeSO_{4(eq)} + Fe_2(SO_4)_{3(eq)} + 4SO_{2(g)} + 8H_2O_{(v)}$$

(22) 
$$(COO)_2 Fe_{(g)} \xrightarrow{\Delta} FeO_{(g)} + CO_{(g)} + CO_{(g)}$$

(23) 
$$\operatorname{Fe_2O_{3(s)}} + \operatorname{H_{2(g)}} \xrightarrow{400^s : 700^s C} 2\operatorname{FeO_{(s)}} + \operatorname{H_2O_{(v)}}$$

(24) 
$$\text{Fe}_3\text{O}_{4(s)} + \text{H}_{2(g)} \xrightarrow{400^\circ : 700^\circ\text{C}} 3\text{FeO}_{(s)} + \text{H}_2\text{O}_{(v)}$$

(25) 
$$4\text{FeO}_{(s)} + O_{2(g)} \xrightarrow{\Delta} 2\text{Fe}_2O_{3(s)}$$

(26) 
$$\text{FeO}_{(s)} + \text{H}_2 \text{SO}_{4(aq)} \xrightarrow{dil} \text{FeSO}_{4(aq)} + \text{H}_2 \text{O}_{(l)}$$

(27) 
$$FeCl_{3(aq)} + 3NH_4OH_{(aq)} \longrightarrow Fe(OH)_{3(s)} + 3NH_4Cl_{(aq)}$$

(28) 
$$2\text{Fe}(OH)_{3(s)} \xrightarrow{>200^{\circ}C} \text{Fe}_2O_{3(s)} + 3\text{H}_2O_{(v)}$$

(29) 
$$2\text{FeSO}_{4(s)} \xrightarrow{\Delta} \text{Fe}_2\text{O}_{3(s)} + \text{SO}_{2(g)} + \text{SO}_{3(g)}$$

(30) 
$$Fe_2O_{3(s)} + 3H_2SO_{4(aq)} \xrightarrow{\Delta} Fe_2(SO_4)_{3(aq)} + 3H_2O_{(v)}$$

(31) 
$$3Fe_2O_{3(s)} + CO_{(g)} \xrightarrow{230^s : 300^sC} 2Fe_3O_{4(s)} + CO_{2(g)}$$

(32) 
$$Fe_3O_{4(s)} + 4H_2SO_{4(t)} \xrightarrow{\Delta} FeSO_{4(aq)} + Fe_2(SO_4)_{3(aq)} + 4H_2O_{(v)}$$

(33) 
$$2\text{Fe}_3\text{O}_{4(s)} + \frac{1}{2}\text{O}_{2(g)} \xrightarrow{\Delta} 3\text{Fe}_2\text{O}_{3(s)}$$

(34) 
$$FeSO_{4(aq)} + 2NaOH_{(aq)} \longrightarrow Na_2SO_{4(aq)} + Fe(OH)_{2(s)}$$

(35) 
$$FeO_{(s)} + H_{2(g)} \xrightarrow{\Delta} Fe_{(s)} + H_2O_{(v)}$$

(36) 
$$\text{FeO}_{(s)} + 2\text{HCl}_{(aq)} \xrightarrow{dil} \text{FeCl}_{2(aq)} + \text{H}_2\text{O}_{(l)}$$

## المعادلات الواردة بالباب الثاني

(1) 
$$Na_2CO_{3(s)} + 2HCl_{(aq)} - 2NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$$

(2) 
$$CO_{2(g)} + Ca(OH)_{2(aq)} \xrightarrow{S.T} CaCO_{3(a)} + H_2O_{(f)}$$

(3) 
$$Na_2CO_{3(aq)} + MgSO_{4(aq)} - Ra_2SO_{4(aq)} + MgCO_{3(a)}$$

(4) 
$$MgCO_{3(a)} + 2HCl_{(aq)} - - - MgCl_{2(aq)} + H_2O_{(l)} + CO_{2(g)}$$

(6) 
$$2NaHCO_{3(aq)} + MgSO_{4(aq)} - Na_2SO_{4(aq)} + Mg(HCO_3)_{2(aq)}$$

(7) 
$$Mg(HCO_3)_{2(mq)} \xrightarrow{\Delta} MgCO_{3(s)} + H_2O_{(f)} + CO_{2(g)}$$

(8) 
$$Na_2SO_{3(s)} + 2HCI_{(aq)} - - - 2NaCI_{(aq)} + H_2O_{(t)} + SO_{2(g)}$$

(9) 
$$K_2Cr_2O_{7(aq)} + 3SO_{2(g)} + H_2SO_{4(aq)} - K_2SO_{4(aq)} + Cr_2(SO_4)_{3(aq)} + H_2O_{(f)}$$

(10) 
$$Na_2SO_{3(aq)} + 2AgNO_{3(aq)} - Ag_2SO_{3(a)} + 2NaNO_{3(aq)}$$

(11) 
$$Na_2S_{(s)} + 2HCI_{(aq)} - 2NaCI_{(aq)} + H_2S_{(g)}$$

(12) 
$$(CH_3COO)_2Pb_{(aq)} + H_2S_{(g)} \longrightarrow 2CH_3COOH_{(aq)} + PbS_{(s)}$$

(13) 
$$Na_2S_{(aq)} + 2AgNO_{3(aq)} - - - 2NaNO_{3(aq)} + Ag_2S_{(s)}$$

(14) 
$$Na_2S_2O_{3(s)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + H_2O_{(t)} + SO_{2(g)} + S_{(s)}$$

(15) 
$$2Na_2S_2O_{3(aq)} + I_{2(aq)} - - Na_2S_4O_{6(aq)} + 2NaI_{(aq)}$$

(16) 
$$NaNO_{2(s)} + HCI_{(aq)} \longrightarrow NaCI_{(aq)} + HNO_{2(aq)}$$

(17) 
$$3HNO_{2(aq)} \longrightarrow HNO_{3(aq)} + H_2O_{(f)} + 2NO_{(g)}$$

(18) 
$$2NO_{(g)} + O_{2(g)} - - 2NO_{2(g)}$$

(20) 
$$2NaCl_{(a)} + H_2SO_{4(f)} - \frac{coac}{\Delta} + Na_2SO_{4(aq)} + 2HCl_{(g)}$$

(21) 
$$HCl_{(g)} + NH_{N(g)} \longrightarrow NH_4Cl_{(s)}$$

(22) 
$$NaCl_{(aq)} + AgNO_{3(aq)} \longrightarrow NaNO_{3(aq)} + AgCl_{(a)}$$

(23) 
$$2NaBr_{(s)} + H_2SO_{4(t)} - \frac{conc.}{\Delta} - Na_2SO_{4(aq)} + 2HBr_{(g)}$$

(24) 
$$2HBr_{(g)} + H_2SO_{4(f)} \xrightarrow{conc} 2H_2O_{(f)} + SO_{2(g)} + Br_{2(v)}$$

(25) 
$$NaBr_{(aq)} + AgNO_{V(aq)} - - - NaNO_{V(aq)} + AgBr_{(v)}$$

(26) 
$$2KI_{(s)} + H_2SO_{4(t)} \xrightarrow{cons} K_2SO_{4(aq)} + 2HI_{(g)}$$

(27) 
$$2HI_{(s)} + H_{2}SO_{4(t)} \xrightarrow{conc} 2H_{2}O_{(t)} + SO_{2(g)} + I_{2(V)}$$

(28) 
$$Nal_{(aq)} + AgNO_{(aq)} - - NaNO_{(aq)} + AgI_{(s)}$$

(29) 
$$2NaNO_{3(s)} + H_2SO_{4(t)} - \frac{conc.}{\Delta} + Na_2SO_{4(aq)} + 2HNO_{3(t)}$$

(30) 
$$4HNO_{3(t)} \xrightarrow{\Delta} 2H_2O_{(t)} + 4NO_{2(g)} + O_{2(g)}$$

(31) 
$$4HNO_{3(t)} + Cu_{(x)} - \frac{cosc}{\Delta} + Cu(NO_3)_{2(nq)} + 2H_2O_{(t)} + 2NO_{2(g)}$$

$$3Fe_2(SO_4)_{3(aq)} + Na_2SO_{4(aq)} + 4H_2O_{(f)} + 2NO_{(g)}$$

(33) 
$$FeSO_{4(aq)} + NO_{(g)} \longrightarrow FeSO_4 NO_{(s)}$$

(34) 
$$2Na_3PO_{4(aq)} + 3BaCl_{2(aq)} - Ba_3(PO_4)_{2(a)} + 6NaCl_{(aq)}$$

(35) 
$$Na_3PO_{4(aq)} + 3AgNO_{3(aq)} - 3NaNO_{3(aq)} + Ag_3PO_{4(a)}$$

(36) 
$$Na_2SO_{4(aq)} + BaCl_{2(aq)} - 2NaCl_{(aq)} + BaSO_{4(s)}$$

(38) 
$$CuSO_{4(nq)} + H_2S_{(g)} \longrightarrow H_2SO_{4(nq)} + CuS_{(n)}$$

(39) 
$$Al_2(SO_4)_{3(aq)} + 6NH_4OH_{(aq)} - 3(NH_4)_2SO_{4(aq)} + 2Al(OH)_{3(a)}$$

(40) 
$$Al_2(SO_4)_{A(aq)} + 6NaOH_{(aq)} \longrightarrow 3Na_2SO_{4(aq)} + 2Al(OH)_{3(a)}$$

(41) 
$$AI(OH)_{3(s)} + NaOH_{(aq)} - NaAIO_{2(aq)} + 2H_2O_{(f)}$$

(42) 
$$FeSO_{4(aq)} + 2NH_4OH_{(aq)} \longrightarrow (NH_4)_2SO_{4(aq)} + Fe(OH)_{2(s)}$$

(43) 
$$FeSO_{4(aq)} + 2NaOH_{(aq)} \longrightarrow Na_2SO_{4(aq)} + Fe(OH)_{2(a)}$$

(44) 
$$FeCl_{3(aq)} + 3NH_4OH_{(aq)} - - - - 3NH_4Cl_{(aq)} + Fe(OH)_{3(s)}$$

(45) 
$$FeCl_{Maq}$$
 +  $3NaOH_{(aq)}$  --------  $3NaCl_{(aq)}$  +  $Fe(OH)_{Max}$ 

(46) 
$$CaCl_{2(aq)} + (NH_4)_2CO_{3(aq)} - - - 2NH_4Cl_{(aq)} + CaCO_{3(a)}$$

(47) 
$$CaCO_{3(x)} + H_2O_{(t)} + CO_{2(g)} - Ca(HCO_3)_{2(aq)}$$

(48) 
$$CaCl_{2(aq)} + H_2SO_{4(aq)} - - - 2HCl_{(aq)} + CaSO_{4(1)}$$

(49) NaOH<sub>(aq)</sub> + HCl<sub>(aq)</sub> 
$$\longrightarrow$$
 NaCl<sub>(aq)</sub> + H<sub>2</sub>O<sub>(f)</sub>

## المعادلات الواردة بالباب الخامس

(1) 
$$NH_4Cl_{(aq)} + AgCNO_{(aq)} \longrightarrow AgCl_{(s)} + NH_4CNO_{(aq)}$$

(2) 
$$NH_4CNO_{(aq)} - \Delta + H_2N - CO - NH_{2(a)}$$

(3) 
$$C + 2CuO_{(s)} \xrightarrow{\Delta} 2Cu_{(s)} + CO_{2(g)}$$

(4) 
$$2H + CuO_{(s)} \xrightarrow{\Delta} Cu_{(s)} + H_2O_{(v)}$$

(5) 
$$CH_3COONa_{(s)} + NaOH_{(s)} \xrightarrow{CaO} CH_{4(g)} + Na_2CO_{3(s)}$$

(6) 
$$CH_{4(g)} + 2O_{2(g)} \xrightarrow{\Delta} CO_{2(g)} + 2H_2O_{(v)} + Energy$$

(7) 
$$CH_{4(g)} + Cl_{2(g)} \xrightarrow{UV} CH_3Cl_{(g)} + HCl_{(g)}$$

(8) 
$$CH_3Cl_{(g)} + Cl_{2(g)} \xrightarrow{UV} CH_2Cl_{2(g)} + HCl_{(g)}$$

(9) 
$$CH_2Cl_{2(g)} + Cl_{2(g)} = UV - CHCl_{3(g)} + HCl_{(g)}$$

(10) 
$$CHCl_{3(g)} + Cl_{2(g)} - UV - CCl_{4(f)} + HCl_{(g)}$$

(11) 
$$C_8 H_{18(f)} = \frac{\Delta P}{cat} + C_4 H_{8(g)} + C_4 H_{10(g)}$$

(12) 
$$CH_{4(g)} = \frac{1000^{\circ}C}{\text{no air}} + 2H_{2(g)} + C_{(s)}$$

(13) 
$$CH_{4(g)} + H_2O_{(v)} = \frac{725^{\circ}C}{cat} + CO_{(g)} + 3H_{2(g)}$$
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(14) 
$$C_2H_5OH_{(f)} + H_2SO_{4(aq)} \xrightarrow{conc} C_2H_5.HSO_{4(aq)} + H_2O_{(f)}$$

(15) 
$$C_2H_5.HSO_{4(aq)} = \frac{180^{\circ}C}{} + C_2H_{4(g)} + H_2SO_{4(aq)}$$

(16) 
$$C_2H_{4(g)} + 3O_{2(g)} = \Delta - 2CO_{2(g)} + 2H_2O_{(v)} + Energy$$

(17) 
$$C_2H_{4(g)} + H_{2(g)} = \frac{\text{Pt or Ni}}{150^{\circ}\text{C} - 300^{\circ}\text{C}} = C_2H_{6(g)}$$

(18) 
$$H_2C = CH_{2(R)} + Br_{2(\ell)} \xrightarrow{CCI_4} Br - CH_2 - CH_2 - Br_{(\ell)}$$

(19) 
$$H_2C = CH_{2(g)} + HBr_{(g)} - CH_3 - CH_2 - Br_{(g)}$$

(20) 
$$C_2H_5HSO_{4(l)} + H_2O_{(l)} - \frac{110^{\circ}C}{} + C_2H_5OH_{(aq)} + H_2SO_{4(aq)}$$

$$(21) C_2 H_{4(g)} + H_2 O_{(f)} \xrightarrow{\text{conc } H_2 SO_4} C_2 H_5 OH_{(f)}$$

(22) 
$$\frac{H}{H}$$
 C = C  $\frac{H}{H}$  + H<sub>2</sub>O + (O)  $\frac{KMnO_4}{\text{alkaline}}$   $\frac{CH_2 - OH}{CH_2 - OH}$ 

(23) 
$$nCH_2 = CH_2 - CH_2 + CH_2 - CH_2 + C$$

(24) 
$$C \equiv C_{(s)} + 2H_2O_{(f)} \longrightarrow H - C \equiv C - H_{(g)} + Ca(OH)_{2(eq)}$$

(25) 
$$2CH_{4(g)} = \frac{1500^{\circ}C}{\text{fast cooling}} = C_2H_{2(g)} + 3H_{2(g)}$$

(26) 
$$2C_2H_{2(g)} + 3O_{2(g)} \xrightarrow{\Delta} 2CO_{2(g)} + 2H_2O_{(v)} + 2C_{(s)}$$

(27) 
$$2C_2H_{2(g)} + 5O_{2(g)} \xrightarrow{\Delta} 4CO_{2(g)} + 2H_2O_{(v)} + 300^{\circ}C$$

(28) 
$$H - C \equiv C - H_{(g)} + H_{2(g)} \xrightarrow{Ni} H_2C = CH_{2(g)} \xrightarrow{+H_2} C_2H_{6(g)}$$

(29) 
$$C_2H_{2(g)} + Br_2 \xrightarrow{CCI_4} + BrCH = CHBr_{(f)} \xrightarrow{+Br_2} + Br - CH - CH - Br_{(f)}$$

(30) 
$$C_2H_{2(g)} + HBr_{(g)} - H_2C = CHBr_{(g)} - HBr_{2(f)} + CH_3 - CHBr_{2(f)}$$

(31) 
$$H - C \equiv C - H_{(g)} + H_2O_{(g)} \frac{H_2SO_4(40\%)}{H_gSO_4/60\%C} \begin{bmatrix} H & OH \\ H - C = C - H \end{bmatrix} \xrightarrow{(c)} CH_3 - CHO_{(f)}$$

(33) 
$$CH_3CHO_{(l)} \xrightarrow{2H} CH_3CH_2OH_{(l)}$$

(34) 
$$CH_3 - (CH_2)_4 - CH_{3(f)} \xrightarrow{\Delta} \bigcirc_{(f)} + 4H_{2(g)}$$

(35) 
$$3C_2H_{2(g)} \xrightarrow{\text{red hot}} C_6H_{6(\ell)}$$

OH
$$(36) \bigcirc_{(v)}^{l} + Zn_{(s)} \xrightarrow{\Delta} \bigcirc_{(f)}^{l} + ZnO_{(s)}$$

(37) 
$$C_6H_5COONa_{(s)} + NaOH_{(s)} \xrightarrow{CaO} C_6H_{6(l)} + Na_2CO_{3(s)}$$

(38) 2 
$$\bigcirc_{(l)}^{CH_3}$$
 +  $2Cl_{2(g)}$   $\xrightarrow{Fe}$   $\bigcirc_{(l)}^{CH_3}$   $\stackrel{CH_3}{\bigcirc_{(l)}}$  +  $2HCl_{(g)}$ 

$$(39) \bigodot_{(f)}^{NO_2} + Cl_{2(g)} \xrightarrow{f_{\overline{v}}} \bigodot_{Cl_{(f)}}^{NO_2} + HCl_{(g)}$$

(40) 
$$\bigcirc_{(l)}$$
 + 3H<sub>2(g)</sub>  $\xrightarrow{\Delta/P}$   $\bigcirc_{(l)}$ 

(41) 
$$\bigcirc_{(l)}^{+}$$
  $3Cl_{2(g)} \xrightarrow{UV} Cl \xrightarrow{Cl} Cl_{(l)}^{Cl}$ 

$$(42) \bigcirc_{(f)} + Cl_{2(g)} \xrightarrow{\text{FeCl}_3} \bigcirc_{(f)} + HCl_{(g)}$$

(43) 
$$\bigcirc_{(l)}$$
 +  $CH_3Cl_{(g)}$   $\xrightarrow{anhydrous AlCl_3}$   $\bigcirc_{(l)}$  +  $HCl_{(g)}$ 

(44) 
$$\bigcirc_{(l)}$$
 + HNO<sub>3(l)</sub>  $\frac{\text{conc H}_2SO_4}{50^{\circ}\text{C}}$   $\bigcirc_{(l)}$   $\frac{\text{NO}_2}{(l)}$  + H<sub>2</sub>O<sub>(v)</sub>

(45) 
$$\bigcirc_{(l)}^{CH_3}$$
 + 3HNO<sub>3(l)</sub>  $\xrightarrow{\text{conc H}_2SO_4}$   $\xrightarrow{NO_2}$   $\xrightarrow{NO_2}$   $\xrightarrow{NO_2}$  + 3H<sub>2</sub>O<sub>(v)</sub>

(46) 
$$\bigcirc_{(t)}^{COBC} + H_2SO_{4(t)} \xrightarrow{coBC} \bigcirc_{(t)}^{SO_3H} + H_2O_{(t)}$$

(47) R 
$$O_3H_{(\ell)} + NBOH_{(eq)} - R - O_3NB_{(eq)}^+ + H_2O_{(\ell)}$$

(48) 
$$C_{12}H_{22}O_{11(s)} + H_2O_{(\ell)} \xrightarrow{\text{hydrolysis}} C_6H_{12}O_{6(aq)} + C_6H_{12}O_{6(aq)}$$

(49) 
$$2C_6H_{12}O_{6(aq)} \xrightarrow{yeast} 4C_2H_5OH_{(f)} + 4CO_{2(g)} + Energy$$

(50) منتجات بترولية 
$$C_2H_{4(g)} + H_2O_{(f)} \xrightarrow{conc H_2SO_4} C_2H_5OH_{(v)}$$

(51) 
$$CH_3 - CH = CH_{2(l)} + H_2O_{(l)} \frac{\text{conc } H_2SO_4}{110^4C} + CH_3 - CH - CH_{3(l)}$$
  
OH

$$(52) CH_3 - C = CH - CH_{3(l)} + H_2O_{(l)} \frac{\text{conc } H_2SO_4}{110^{6}C} - CH_3 - \frac{1}{1} - CH_2 - CH_{3(l)}$$

(53) 
$$C_2H_5Br_{(f)} + KOH_{(aq)} \xrightarrow{\Delta} C_2H_5OH_{(aq)} + KBr_{(aq)}$$

(54) 
$$(CH_3)_2CHBr_{(f)} + KOH_{(aq)} - \frac{UL}{\Delta} + (CH_3)_2CHOH_{(aq)} + KBr_{(aq)}$$

(55) 
$$(CH_3)_3CCl_{(f)} + KOH_{(aq)} \xrightarrow{ijll} (CH_3)_3COH_{(aq)} + KCl_{(aq)}$$

(56) 
$$2C_2H_5OH_{(t)} + 2Na_{(s)} - 2C_2H_5ONa_{(t)} + H_{2(g)}$$

(57) 
$$C_2H_5ONa_{(t)} + H_2O_{(t)} - C_2H_5OH_{(aq)} + NaOH_{(aq)}$$

(58) 
$$CH_3COOH_{(f)} + C_2H_5OH_{(f)} \xrightarrow{conc} CH_3COOC_2H_{5(aq)} + H_2O_{(f)}$$

(59) 
$$C_2H_5OH_{(I)} + HCI_{(I)} \xrightarrow{Z_BCI_2} C_2H_5CI_{(aq)} + H_2O_{(I)}$$

(60) 
$$CH_3CH_2OH_{(l)} \xrightarrow{[O]} CH_3CHO_{(l)} \xrightarrow{[O]} CH_3COOH_{(l)}$$

(61) 
$$CH_3 - \overset{|}{C} - CH_{3(l)} - \overset{|}{C} + CH_3 - \overset{|}{C} - CH_{3(l)} + H_2O$$
  
OH

(62) 
$$C_2H_5OH_{(f)} \xrightarrow{cosc H_2SO_4} C_2H_{4(g)} + H_2O_{(v)}$$

(63) 
$$2C_2H_5OH_{(f)} = \frac{\cos H_2SU_4}{140'C} + C_2H_5OC_2H_{5(g)} + H_2O_{(v)}$$

$$CH_{2} - OH 
(64) CH - OH + 3HNO3(l)  $\xrightarrow{\text{coac}}$   $CH_{2} - ONO_{2} + 3H_{2}O_{(v)}$   
 $CH_{2} - OH_{(l)}$   $CH_{2} - ONO_{2(l)}$$$

(65) 
$$\bigcirc$$
 (7) + NaOH  $\xrightarrow{300^{\circ}C}$   $\bigcirc$  (9) + NaCl (aq)

OH
$$(66) \bigcirc_{(f)}^{OH} + 3HNO_{3(f)} \xrightarrow{\text{coac}}^{\text{coac}} O_2^{\text{N}} \bigcirc_{(s)}^{OH} NO_2 + 3H_2O_{(f)}$$

$$NO_2$$

(68) 
$$2CH_3COOH_{(eq)} + Mg_{(s)} - (CH_3COO)_2Mg_{(eq)} + H_{2(g)}$$

(69) 
$$CH_3COOH_{(eq)} + NaHCO_{3(e)} \longrightarrow CH_3COONa_{(eq)} + H_2O_{(f)} + CO_{2(g)}$$

(70) 
$$CH_3COOH_{(aq)} + NaOH_{(aq)} \longrightarrow CH_3COONa_{(aq)} + H_2O_{(f)}$$

(71) 
$$CH_3COOH_{(eq)} + 2H_{2(g)} \xrightarrow{CuCrO_4} C_2H_5OH_{(v)} + H_2O_{(v)}$$

(72) 2 
$$\bigcirc_{(\ell)}$$
 + 3O<sub>2(g)</sub>  $\xrightarrow{v_2O_5}$  2  $\bigcirc_{(eq)}$  + 2H<sub>2</sub>O<sub>(v)</sub>

(73) 
$$C_6H_5COOH_{(I)} + NaOH \longrightarrow C_6H_5COONa_{(aq)} + H_2O_{(I)}$$

(74) 
$$C_6H_5COOH_{(f)} + C_2H_5OH \xrightarrow{dry} C_6H_5COOC_2H_{5(eq)} + H_2O_{(f)}$$

$$(76) CH_3 - C - OC_2H_{5(t)} + H_2O_{(t)} - H^* + CH_3COOH_{(24)} + C_2H_5OH_{(t)}$$

(77) 
$$CH_3COOC_2H_{5(I)} + NBOH_{(aq)} - CH_3COONa_{(aq)} + C_2H_5OH_{(I)}$$

(78) 
$$C_6H_5COOC_2H_{5(aq)} + NaOH_{(aq)} \longrightarrow C_6H_5COONa_{(aq)} + C_2H_5OH_{(aq)}$$

(79) 
$$CH_3COOC_2H_{5(l)} + NH_{3(g)} \longrightarrow CH_3CONH_{2(l)} + C_2H_5OH_{(l)}$$

(80) 
$$C_6H_5COOC_2H_{5(1)} + NH_{3(g)} \longrightarrow C_6H_5CONH_{2(1)} + C_2H_5OH_{(1)}$$

(82) 
$$HO - CH_2 - CH_2$$

(84) 
$$\bigcirc COOH O H_{O[H_{(l)}^{+}+HO]} - C - CH_{3(l)} \longrightarrow \bigcirc COOH O H_{O-C-CH_{3(a)}} + H_2O_{(l)}$$

(86) 
$$\text{HCOOH}_{(l)} + \text{CH}_3\text{OH}_{(l)} \xrightarrow{\text{conc.}} \text{HCOOCH}_{3(\text{aq})} + \text{H}_2\text{O}_{(l)}$$

(88) 
$$CH_3 - CH = CH_{2(g)} + HBr_{(g)} - CH_3 - CHBr - CH_{3(f)}$$

(89) 
$$CH_3 - CHBr - CH_3 + KOH - CH_3 - CHOH - CH_3 + KBr$$

(91) 
$$CH_3 - CH_2 - CH = CH_2 + HBr - CH_3 - CH_2 - CHBr - CH_3$$

(92) 
$$CH_3 - CH = CH - CH_3 + HBr - CH_3 - CH_2 - CHBr - CH_3$$

(93) 
$$CH_3 - C(CH_3) = C(CH_3) - CH_3 + HBr - CH_3 - CH(CH_3) - CBr(CH_3) - CH_3$$

(94) 
$$H_2C = C(CH_3) - CH_3 + HBr - CH_3 - CBr(CH_3) - CH_3$$

$$(95) \bigcirc + 3Cl_2 \xrightarrow{Fe} Cl \bigcirc Cl_3 + 3HCl$$

$$(96) \bigcirc + H_2SO_4 \xrightarrow{conc} \bigcirc CH_3 SO_3H + H_2O$$

(97) 2 
$$\bigcirc$$
 + 2HNO<sub>3</sub>  $\xrightarrow{\text{conc}}$  +  $\bigcirc$   $\bigcirc$   $\bigcirc$  NO<sub>2</sub> +  $\bigcirc$  + 2H<sub>2</sub>O

(98) 
$$CH_3 - CH_2 - CH_2OH \frac{conc H_2SO_4}{180^{\circ}C} - CH_3 - CH = CH_2 + H_2O$$

(99) 
$$CH_3 - CH = CH_2 + H_2O + [O] \xrightarrow{KMtsO_4} CH_3 - CH_$$

(102) 
$$CH_3(CH_2)_2CH_2Br + KOH_{(aq)} \xrightarrow{\Delta} CH_3(CH_2)_2CH_2OH + KBr$$

(103) 
$$CH_3 - CH_2 - CHBr - CH_3 + KOH_{(aq)} \xrightarrow{\Delta} CH_3 - CH_2 - CHOH - CH_3 + KBr$$

$$\begin{array}{ccc}
 & CH_{3} & CH_{3} \\
 & CH_{3} - CH_{3} + KOH_{(eq)} & \Delta & CH_{3} - CH_{3} + KBr \\
 & Br & OH
\end{array}$$

$$(105) \text{ CH}_{3}(\text{CH}_{2})_{2}\text{CH}_{2}\text{OH} \xrightarrow{[O]} \text{CH}_{3}(\text{CH}_{2})_{2}\text{CHO} \xrightarrow{[O]} \text{CH}_{3}(\text{CH}_{2})_{2}\text{COOH}$$

(106) 
$$CH_3 - CH_2 - CHOH - CH_3 - \frac{(O)}{-H_2O} - CH_3 - CH_2 - \frac{O}{C} - CH_3$$

(109) 
$$2C_6H_5COOH + Mg - (C_6H_5COO)_2Mg + H_2$$

(111) 
$$CH_3CI + NaOH_{(aq)} \xrightarrow{\Delta} CH_3OH + NaCI$$

(116) 
$$C_2H_5COOH + CH_3OH \xrightarrow{conc} C_2H_5COOCH_3 + H_2O$$

(120) 
$$C_2H_{6(g)} + Br_{2(f)} - UV - C_2H_5Br_{(g)} + HBr_{(g)}$$

(121) 
$$CH_2 = CH_{2(g)} + HOSO_3H_{(eq)} \xrightarrow{80^{\circ}C} CH_3CH_2OSO_3H_{(eq)}$$